

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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NOVEMBER 10, 1905.

No. 1

W. H. MAW, Esq., PRESIDENT, in the Chair.

Walter Sidney Adams, M.A., Solar Observatory, Mount Wilson, California, U.S.A. ;

Ernest Percival Cotton, Lands and Survey Department, Lagos, West Africa ;

Rev. Alexander C. Henderson, B.D., The Manse, Delting, Brae, Shetland, N.B. ;

Rev. Frederick John Jervis-Smith, M.A., F.R.S., M.Inst.E.E., Trinity College, Oxford, and Battramsley House, Lymington, Hants ; and

T. Hobart Pritchard, 5 Cotford Road, Thornton Heath, Surrey,

were balloted for and duly elected Fellows of the Society.

The following candidates were proposed for election as Fellows of the Society, the names of the proposers from personal knowledge being appended :—

Lieut. George Alfred Alcock, R.N.R., c/o Shaw Savill & Albion Co., Royal Albert Dock (proposed by M. W. Campbell Hepworth) ;

Hugh Daniel Badcock, M.A., Assoc. Mem. Inst. C.E., Town Engineer, Pretoria, Transvaal, South Africa (proposed by R. T. A. Innes) ;

Rev. Arthur Edwin Brisco-Owen, M.A., The Rectory, Cholderton, Salisbury (proposed by the Rev. Charles D. P. Davies) ;

William Robert Bruce, Observatorio Magnetico, Pilar, Provincia de Córdoba, Argentine Republic (proposed by Ralph Copeland) ;

- Lieut. Herbert Archer Edwards, R.N.R., Marine Office, Lagos, West Africa (proposed by Thomas Lewis) ;
 Crawford M. Fleming, 14 North Kinver Road, Sydenham, S.E. (proposed by the Rev. D. Fleming) ;
 William Edgar Geil, M.A., F.R.G.S., Doylestown, Pa., U.S.A., and 103 Pall Mall, S.W. (proposed by E. A. Reeves) ;
 Thomas Henry Leale, A.K.C., Chaplain of Lambeth Infirmary, 65 Gaskarth Road, Balham Hill, S.W. (proposed by the Rev. F. B. Allison) ;
 Lieut. Frederick William Mace, R.N.R., 2 Rutland Avenue, Sefton Park, Liverpool (proposed by Thomas Lewis) ;
 William Ottway, Orion Works, Ealing, W. (proposed by A. Fowler) ;
 Legh Richmond Powell, 10 Cranfield Road, Bexhill-on-Sea, Sussex (proposed by the Rev. F. B. Allison) ;
 Rev. John Gardham Reed, Burlington Manse, South Road, Saffron Walden, Essex (proposed by the Rev. William Smith) ; and
 Richard Frind Roberts, Chartered Accountant, Westcroft, Warlingham, Surrey (proposed by John Evershed).

One hundred and eighty-two presents were announced as having been received since the last meeting, including, amongst others :—

Miss A. M. Clerke, *The System of the Stars*, 2nd edition, presented by the author ; Galileo, *Opere*, Edizione Nazionale, vol. 16, presented by the Italian Government ; Dyson and Thackeray, *New Reduction of Groombridge's Circumpolar Catalogue*, presented by the Royal Observatory, Greenwich ; G. W. Hill, collected mathematical works, presented by the author ; Percival Lowell, *Drawings of Mars*, 1903, presented by the author ; A. Marcuse, *Handbuch der geographischen Ortsbestimmung*, presented by the author ; G. V. Schiaparelli, *Astronomy in the Old Testament*, presented by the Clarendon Press, Oxford.

Further charts of the *Astrographic Chart of the Heavens*, presented by the Royal Observatory, Greenwich, and the Paris Observatory ; Loewy and Puiseux, *Atlas Photographique de la Lune*, fasc. 8, presented by the Paris Observatory.

Photographs of the seventh satellite of *Jupiter* taken at the Lick Observatory, presented by Professor Perrine ; photographs of instruments and of the eclipse of 1905, presented by Rev. R. Killip ; portrait (photograph) of Professor Loewy, presented by Professor Turner ; photograph of the Lacaille Memorial at the Cape, presented by the South African Philosophical Society.
 Small ring dial, presented by Mr. Wm. Ellis.

On the Secular Acceleration of the Earth's Orbital Motion.

By P. H. Cowell, M.A.

In a paper in the Supplementary Number of the *Monthly Notices* I showed that the ancient solar eclipses are satisfied by adopting the following secular terms :

1. In the distance of the Moon from the node $+4''.4$
2. In the distance of the Moon from the Sun $+6''.8$

and this month, in a separate paper, I show that these conclusions are supported by the Ptolemaic eclipses of the Moon recorded in the *Almagest*.

I then reasoned in the following way : The Sun must be assumed to have no sidereal secular acceleration. Therefore the sidereal secular acceleration of the Moon is $+6''.8$ and of the node $+2''.4$. On sending this result to Professor Newcomb, I received a reply alluding sarcastically to the "beautiful consistency . . . for a result contravening gravitational theory." Professor Newcomb is quite right, and I can only express my obligation to him for putting his arguments as forcibly as he did.

A day or two later the following modification of my argument suggested itself to me. Let us accept the value $+6''.5$ as the sidereal secular acceleration of the node. It follows then from the ancient eclipses that $+10''.9$ is the sidereal acceleration of the Moon and $+4''.1$ that of the Sun.

This alteration of my conceptions only affects one part of the numerical calculations of my late paper on solar eclipses, and that part only to an unimportant degree. The formulæ I gave for the longitude of the node and the longitude of the Sun were intended to represent these longitudes measured from the equinox. They really represent the longitudes measured from an arbitrary departure point $+4''.1T^2$ in advance of the equinox. With this change of definition no figure in the calculations requires alteration until we come to the corrections for parallax. Now the effect of substituting the true equinox for the departure point, which is about one-hundredth part of a radian away from it, can at the outside only affect the corrections for parallax by 1 per cent. or $20''$. Corrections of this magnitude are unimportant.

One other change is required. Instead of putting $\Delta V = T^2 s_L$, I should have put $\Delta(V - V') = T^2 \cdot s_D$, where s_D is the correction to the assumed secular acceleration of the mean elongation.

A secular acceleration of the Earth's orbital motion does not "contravene gravitational theory," for it may be ascribed to the resistance of the ether. The sum of the kinetic and potential energies of the Earth in its orbit is equal to the potential energy it would have at a distance from the Sun equal to twice

its mean distance. A secular acceleration of $1''$ per century, or an increase per century of $2''$ in its centennial motion, or one part in 64,800,000, corresponds with a decrease of the mean distance of one part in 97,200,000. The loss of energy is therefore equal to the attraction of the Sun at double mean distance multiplied by twice the above fraction of the mean distance, which is equal to the attraction of the Sun at mean distance multiplied by the mean distance and divided by 194,400,000. If this loss of energy is sustained by the Earth in passing through 100 circumferences of its orbit, we conclude that the retarding force corresponding to a secular acceleration of a second is equal to the attraction of the Sun divided by $194,400,000 \times 2\pi \times 100$. For the secular acceleration found by me the divisor is 3×10^{10} nearly.

In order to obtain the theoretical secular acceleration of the node, Professor Newcomb's advice to me was: "Take Brown's mean motion of the node and differentiate it." The calculation is an easy one and goes as follows:

According to Professor Brown (*Monthly Notices*, vol. lxi. p. 532) the centennial motion of the node contains the following terms, proportional to the square of the solar eccentricity:

$$-2546-57+8 = 2595''$$

From Professor Newcomb's tables of the Sun the solar eccentricity contains a factor

$$1 - T \times 0.002507 - T^2 \cdot 0.00000752$$

T being measured in centuries from 1850, and its square therefore contains the factor

$$1 - T \times 0.005014 - T^2 \cdot 0.00000875$$

and the mean motion of the node the variable part

$$+T \times 13''.01 + T^2 \times 0''.023$$

the longitude of the node (measured from a fixed point, and not a moving equinox) contains terms

$$+T^2 \times 6''.50 + T^3 \times 0''.008$$

where the epoch is 1850, but may be taken as 1800 without sensible error.

By Mr. Crommelin's suggestion (I owe much to his many suggestions, that are based on a very wide acquaintance with astronomical literature) I have examined the transits of *Mercury* with a view to ascertaining whether the secular acceleration of the Earth is supported by them. I find on solving the equations of condition

secular acceleration of <i>Mercury</i>	...	...	0''·0
secular acceleration of <i>Earth</i>	...	...	3''·0

Details will shortly be published. It will be noted that the two entirely distinct methods of deducing a secular acceleration for the *Earth* are in close accordance. The zero result for *Mercury* is an argument against the cause being the resistance of the ether.

On the Ptolemaic Eclipses of the Moon recorded in the Almagest.

By P. H. Cowell, M.A.

The nature of the changes in the secular terms of the lunar and solar tables now in use, that I am advocating, may be described as follows :—

1. A correction of $-0''·6$ to the secular term of the longitude of the node to bring it into accordance with Professor Brown's calculations.
2. A correction of $-1''·6$ to the secular term in the mean elongation.
3. A correction of $+3''·0$ to the secular term in the argument of latitude.

In order to see what light the ancient lunar eclipses throw upon these corrections it will be remarked :

1. The position of the equinox does not enter into a lunar eclipse. We can only hope, therefore, to obtain from lunar eclipses the relative positions of the Sun, Moon, and node, and we cannot hope to get the position of the equinox in addition.
2. The present *Nautical Almanac* is based upon Professor Newcomb's researches. Mr. Nevill has already shown (*Monthly Notices*, vol. xxxix.) that the result obtained by Professor Newcomb was the consequence of what Mr. Nevill deems the excessive weight given to the first eclipse of the series. The proper remark, therefore, to pass upon my second correction is that it is in accordance with Mr. Nevill. I do not pursue this branch of the inquiry, for observations considered by Professor Newcomb to have a probable error of 20 minutes of time or $600''$ are not to be combined with observations of solar eclipses where a residual of $100''$ would not be tolerated.

3. A correction of $+3''·0$ to the secular term of the argument of latitude combined with $-1''·6$ to the mean elongation produces $+4''·6$ in the distance of the Sun from the node, on which depends the magnitude of the eclipse. Professor Newcomb has not discussed the magnitudes of the eclipses. In this connection I have made the following calculations :

Taking as a starting-point Professor Newcomb's table on p. 41 of his *Researches*, I have added or subtracted one-tenth of the difference in longitude to the Moon's latitude. In this

way I have found the Moon's latitude at conjunction in longitude; and I may add that this process is far more accurate than the roundness of the number would suggest. From the latitude at conjunction I took off $\frac{1}{2}$ per cent., and so formed the quantity "Hansen's ∇ ," or nearest approach of the centre of Moon and centre of shadow according to Hansen's tables.

To calculate the effect of my corrections on ∇ I first calculated the effect of Newcomb's corrections to Hansen, and then that of my corrections to the present tables.

$$\Delta \nabla = \pm \frac{120}{111} \left[\frac{1}{111} \Delta F - \frac{1}{10} \Delta D \right]$$

where

$$\Delta F = -20''.05T + 3''.05T^2$$

$$\Delta D = -1''.44T - 1''.44T^2$$

for my corrections,

and

$$\Delta F = \Delta D = -29''.17T - 3''.76T^2$$

for Newcomb's corrections.

It is clear that Newcomb's corrections to Hansen's ∇ are small, for Professor Newcomb did not alter the distance of the Sun from the node. My corrections to Newcomb's ∇ range from $5''.1$ to $2''.4$.

The radius of shadow is calculated from the formula $p + p' - \sigma$, when p , σ are given in the table on p. 41 of the *Researches* and p' is taken as $9''$. Lastly, the radius of the Moon was taken as $0.273 \times p$ and the magnitude of the eclipse as $\frac{\Sigma + \mu - |\nabla|}{2\mu}$,

$|\nabla|$ of course being taken positively.

In the following table the results are tabulated.

Newcomb's Eclipse No.	Date.	Hansen's ∇	$\Delta \nabla$		Radius of Shadow Σ	Magnitude of Eclipse.		
			N.	O.		N.	O.	O.
1	-720	+ 6'.8	+ 0'.2	+ 5'.1	39'.9	1.58	1.41	total
2	-719	+ 47'.8	+ 0.2	+ 5.1	38.0	0.16	0.00	3 digits = 0.25
3	-719	- 43'.5	- 0.2	- 5.1	45.3	0.55	0.40	more than half
4	-620	+ 51'.8	- 0.2	- 4.8	38.3	0.05	0.21	0.25
5	-522	- 41'.1	+ 0.2	+ 4.4	38.5	0.45	0.60	0.5
6	-501	+ 49'.8	- 0.2	- 4.4	37.6	0.09	0.24	0.25
7	-490	+ 57'.7	- 0.2	- 4.4	42.1	0.01	0.15	2 digits = 0.17
8*	-382	- 56.0	+ 0.2	+ 3.9	43.8	0.13	0.25	small
9	-381	+ 44.2	- 0.2	- 3.9	38.6	0.31	0.44	—
10	-381	- 15.4	+ 0.2	+ 3.9	45.2	1.40	1.52	total

* In eclipse No. 8 Professor Newcomb has pointed out that the Moon with his corrections had already set. I regret to say that a similar remark applies to my corrections.

New- comb's Eclipse No.	Date.	Hansen's ∇	$\Delta \nabla$		Radius of Shadow Σ	Magnitude of Eclipse.		
			N.	O.		N.	O.	O.
11	-200	+35'2	-0'1	-3'4	39'5	0'67	0'78	partial
12	-199	+13'4	+0'1	+3'4	42'5	1'41	1'30	total
13	-199	-6'6	-0'1	-3'4	42'6	1'62	1'51	total
14	-173	-40'9	-0'1	-3'3	45'4	0'64	0'53	7 digits = 0'58
15	-140	+52'9	+0'1	+3'2	45'2	0'27	0'17	3 digits = 0'25
16	+125	+55'7	-0'1	-2'4	42'6	0'09	0'17	0'17
17	+133	-24'1	+0'1	+2'4	39'1	1'00	1'08	total
18*	+134	-28'7	-0'1	-2'4	39'5	0'85	0'77	[0'33]
19	+136	-48'5	+0'1	+2'4	44'6	0'38	0'46	0'50

It will be evident from the explanation, but it should be stated in close proximity to the table, that the columns headed "N." are not copied from Professor Newcomb, but are computations of my own to correspond with "Newcomb's corrections."

This table on the whole exhibits some slight evidence in favour of my correction to the distance between the Sun and the Moon's node. In fact, the error only amounts to 0'1 in the case of the first two eclipses. It will be noticed that in the first three eclipses we find the phrase: "is recorded as having occurred." In the other eclipses we find the more positive assertion: "occurred."

*Observation of the Partial Eclipse of the Sun, 1905 August 29-30,
at the Radcliffe Observatory, Oxford.*

(Communicated by Dr. Arthur A. Rambaut, F.R.S., Radcliffe Observer.)

The time of first contact was well observed by Mr. Wickham, with a telescope which is permanently attached to the mounting of the 18-inch and 24-inch telescopes. The object-glass of this instrument is of 7 inches aperture, and its focal length is nearly 10 feet; the eyepiece employed was an ordinary solar diagonal of power 125.

Clouds had for some time prevailed, but fortunately for a short interval before contact the obscuration diminished, until only a very thin haze remained; through this the surface markings of the Sun's disc were neatly and clearly seen, and the limb was steady and sharply defined.

The first trace of indentation by the advancing limb of the Moon was easily detected, and the time registered by means of

* In eclipse No. 18 the observed magnitude was perhaps 0'67 and an error of copying has occurred.

the electric chronograph. The instant thus recorded, when expressed in Greenwich mean time, was

$$23^{\text{h}} 47^{\text{m}} 3^{\text{s}}.8$$

which is practically identical with the time (predicted to the decimal of a minute) in the *Nautical Almanac*, viz.

$$23^{\text{h}} 47^{\text{m}}.1$$

By watching the rate of progress of the indentation for some seconds the observer estimated that external geometrical contact took place 2 seconds earlier than the time registered. The Moon's motion was rapid.

Broken clouds soon supervened, and ultimately the sky became thickly overcast, the final contact being invisible.

Radcliffe Observatory, Oxford:
1905 November 6.

Observations of Comet d 1902 from Photographs taken with the 30-inch Reflector of the Thompson Equatorial at the Royal Observatory, Greenwich.

(Communicated by the Astronomer Royal.)

The following positions of Comet d 1902 are obtained from photographs with the 30-inch reflector. As a rule there were two images on each plate, and the exposures varied from 10^m to 20^m. The plates were measured in the Astrographic Micrometer. Four reference stars were taken in each case, situated as symmetrically as possible about the comet. The positions of the reference stars were derived from the Catalogues of the *Astronomische Gesellschaft*.

Date and G.M.T.				Apparent R.A.			Apparent Dec.			Log. Δ.	Corr. for Parallax.	
											R.A.	Dec.
1902.	h	m	s	h	m	s	°	'	"		s	'
Dec. 29	12	2	54	7	4	32.07	3	16	43.6	0.2917	-0.03	+3.3
	30	12	36 32	7	3	49.67	3	32	55.3	0.2903	+0.01	+3.3
	31	11	59 17	7	3	8.62	3	48	37.6	0.2889	-0.02	+3.3
1903.												
Jan. 2	11	33	4	7	1	43.99	4	21	19.9	0.2866	-0.04	+3.3
	3	10	39 33	7	1	2.45	4	37	34.5	0.2855	-0.07	+3.3
	7	10	31 23	6	58	7.37	5	47	15.5	0.2818	-0.07	+3.3
	7	10	57 55	6	58	6.52	5	47	35.8	0.2818	-0.05	+3.3
	8	11	34 30	6	57	21.20	6	6	3.4	0.2809	-0.01	+3.3
	15	11	29 1	6	52	14.79	8	17	3.9	0.2779	+0.01	+3.2

Date and G.M.T.				Apparent R.A.	Apparent Dec.	Log. Δ .	Corr. for Parallax.	
							R.A.	Dec.
1903.	h	m	s	h	m	s		
Jan. 15	11	47	49	6 52 14.30	8° 17' 19".4	0.2779	+ .03	+ 3".2
25	10	20	57	6 45 33.30	11 33 26.3	0.2797	- .01	+ 2.9
28	9	19	23	6 43 48.56	12 32 40.8	0.2816	- .05	+ 2.9
Feb. 1	10	27	10	6 41 40.07	13 53 34.1	0.2852	+ .03	+ 2.8
2	9	36	23	6 41 12.17	14 12 46.8	0.2901	- .01	+ 2.7
16	10	32	39	6 36 51.23	18 42 17.0	0.3110	+ .08	+ 2.4
17	9	38	2	6 36 44.11	18 59 49.9	0.3128	+ .04	+ 2.3
18	7	14	24	6 36 38.92	19 16 7.5	0.3147	- .07	+ 2.3
21	9	33	49	6 36 30.35	20 11 9.0	0.3205	+ .05	+ 2.2
23	8	10	18	6 36 33.03	20 44 51.0	0.3247	0.0	+ 2.1
25	7	19	46	6 36 42.09	21 18 15.7	0.3288	- .05	+ 2.1
26	7	21	7	6 36 49.06	21 35 0.3	0.3310	- .04	+ 2.1
28	7	50	58	6 37 8.33	22 8 16.1	0.3353	- .01	+ 2.0
Mar. 1	7	22	7	6 37 20.09	22 24 8.0	0.3374	- .03	+ 2.0
3	8	44	46	6 37 49.92	22 56 50.2	0.3419	+ .04	+ 1.9
4	7	50	16	6 38 6.33	23 11 50.8	0.3442	.00	+ 1.9
6	7	14	32	6 38 44.82	23 42 7.2	0.3487	- .02	+ 1.8
6	7	34	14	6 38 45.00	23 42 19.0	0.3487	- .01	+ 1.8
11	7	37	56	6 40 50.79	24 55 40.7	0.3603	+ .01	+ 1.7
11	7	57	8	6 40 51.22	24 55 51.6	0.3603	+ .02	+ 1.7
12	8	12	56	6 41 21.40	25 10 5.9	0.3627	+ .04	+ 1.7
12	8	38	52	6 41 21.99	25 10 20.4	0.3627	+ .06	+ 1.7
13	7	24	39	6 41 51.91	25 23 30.7	0.3650	.00	+ 1.7
13	7	47	20	6 41 52.38	25 23 44.7	0.3650	+ .02	+ 1.7
15	7	27	35	6 42 59.49	25 50 45.9	0.3698	+ .01	+ 1.6
16	9	12	37	6 43 38.19	26 5 2.5	0.3722	+ .09	+ 1.7
21	7	50	30	6 46 59.06	27 8 1.4	0.3840	+ .04	+ 1.5

Further details of the observations will be given in the Greenwich Volume for 1904.

Observations of the Satellite of Neptune from Photographs taken at the Royal Observatory, Greenwich, between 1904 November 11 and 1905 April 15.

(Communicated by the Astronomer Royal.)

The following measures of position-angle and distance of *Neptune's* satellite were made from photographs taken with the 26-inch refractor of the Thompson Equatorial. The occulting shutter was used, as in previous years. The photographs were taken by Messrs. Davidson, Edney, or Melotte, and were measured in a position micrometer in direct and reversed positions by Messrs. Edney and Burkett. The tabular positions with which comparison is made were computed from the data given in the *Connaissance des Temps*, based on Dr. Hermann Struve's elements, the eccentricity of the orbit being neglected.

A discussion of these residuals gives the following differences in the sense Tabular-Observed to Dr. Hermann Struve's elements.

$$du = -0^{\circ}72. \quad dN = -0^{\circ}89. \quad dI = -0^{\circ}27. \quad da = +''086;$$

giving for the epoch 1905.1

$$a = 16''.185. \quad N = 188^{\circ}26. \quad I = 117^{\circ}14.$$

NEPTUNE AND SATELLITE.

Position-angle and Distance from Photographs taken with the 26-inch Refractor.

Date and G.M.T.					Position-angle.			Distance.		
					Observed.	Tabular.	T-O.	Observed.	Tabular.	T-O.
1904.	d	h	m	s						
Nov.	11	12	1	38	315°77	317°91	+ 2°14	12''47	12''82	+ 0''35
	11	12	37	34	315°66	316°23	+ 0°57	12°76	12°97	+ °21
	14	12	52	18	131°53	131°60	+ 0°07	13°20	13°43	+ °23
	14	13	25	32	128°86	130°18	+ 1°32	13°56	13°57	+ °01
	15	12	3	45	84°89	86°80	+ 1°91	16°20	16°68	+ °48
	22	11	45	23	20°87	23°73	+ 2°86	11°28	11°49	+ °21
	22	12	19	12	22°97	21°71	- 1°26	11°46	11°41	- °05*
	22	13	3	38	19°37	19°00	- 0°37	11°70	11°31	- °39
	22	13	33	54	15°77	17°13	+ 1°36	11°57	11°24	- °33
Dec.	5	12	14	20	288°13	289°97	+ 1°84	15°39	15°77	+ °38
	5	12	42	16	288°00	289°09	+ 1°09	15°48	15°85	+ °37
	5	13	7	49	288°02	288°28	+ 0°26	15°78	15°93	+ °15
	7	11	7	55	178°29	178°25	- 0°04	10°80	11°06	+ °26
	20	10	33	31	98°63	99°49	+ 0°86	16°56	16°62	+ °06

* Neptune on edge of occulting shutter.

Date and G.M.T.					Position-angle.			Distance.		
					Observed.	Tabular.	T—O.	Observed.	Tabular.	T—O.
1905.	d	h	m	s						
Jan.	9	9	52	4	307°67	308°77	+ 1°10	13''45	13''64	+ ''19
	9	10	24	28	307°20	307°40	+ 0°20	13°53	13°78	+ '25
	10	9	19	11	263°01	263°91	+ 0°90	16°86	16°79	— '07
	10	9	49	47	262°79	263°05	+ 0°26	16°57	16°76	+ '19
	17	10	14	18	194°26	195°24	+ 0°98	11°41	11°29	— '12
	17	10	47	8	191°11	193°19	+ 2°08	11°03	11°23	+ '20
	25	10	10	50	68°94	69°07	+ 0°13	15°67	15°67	'00
	25	10	40	1	67°77	68°13	+ 0°36	15°62	15°57	— '05
	25	11	6	48	66°98	67°25	+ 0°27	15°50	15°48	— '02
Feb.	2	10	18	9	282°74	282°77	+ 0°03	15°97	16°17	+ '20
	2	10	55	15	281°21	281°66	+ 0°45	16°11	16°26	+ '15
	6	10	32	56	54°26	55°80	+ 1°54	13°83	14°21	+ '38
	6	11	9	11	53°42	54°37	+ 0°95	13°64	14°05	+ '41
	16	8	39	58	146°60	146°55	— 0°05	11°62	11°91	+ '29
	17	11	21	31	86°69	88°25	+ 1°56	17°08	16°69	— '39
	17	11	46	39	85°91	87°55	+ 1°64	16°98	16°69	— '29
Mar.	2	8	50	23	28°90	27°50	— 1°40	11°35	11°66	+ '31*
	2	9	28	6	27°02	25°36	— 1°66	11°26	11°54	+ '28*
	2	10	1	57	24°15	23°40	— 0°75	11°59	11°44	— '15
	3	9	8	11	301°94	304°28	+ 2°34	13°89	13°69	— '20
	3	9	35	53	303°06	303°16	+ 0°10	13°25	13°81	+ '56
	3	10	12	7	301°64	301°72	+ 0°08	13°90	13°96	+ '06
	9	9	19	26	295°76	296°18	+ 0°42	14°18	14°51	+ '33
	17	7	19	11	183°23	186°22	+ 2°99	10°50	10°80	+ '30
	17	7	51	42	183°71	184°12	+ 0°41	10°60	10°77	+ '17
	21	7	31	1	287°84	288°64	+ 0°80	14°99	15°21	+ '22
	21	8	2	56	286°32	287°62	+ 1°30	15°38	15°31	— '07
	21	8	27	51	285°32	286°82	+ 1°50	14°76	15°38	+ '62
	21	8	58	46	285°38	285°85	+ 0°47	14°94	15°48	+ '54
	22	7	47	15	245°67	245°82	+ 0°15	14°96	15°01	+ '05
	22	8	12	22	243°60	244°98	+ 1°38	14°72	14°92	+ '20
	22	8	55	5	242°85	243°53	+ 0°68	14°71	14°77	+ '06
	22	9	18	30	242°85	242°73	— 0°12	14°78	14°68	— '10
	23	7	30	56	173°00	173°99	+ 0°99	11°00	10°73	— '27
	23	8	4	31	170°89	171°81	+ 0°92	10°72	10°75	+ '03
	24	7	48	7	104°60	105°30	+ 0°70	15°32	15°50	+ '18
	24	8	26	36	103°21	104°12	+ 0°91	15°57	15°61	+ '04

* Neptune on edge of occulting shutter.

Date and G.M.T.					Position-angle.			Distance. †		
					Observed.	Tabular.	T-O.	Observed.	Tabular.	T-O.
1905.	d	h	m	s						
Mar.	27	7	48	11	281° 98	282° 60	+ 0° 62	15" 78	15" 71	- " 07
	27	8	21	49	280° 98	281° 60	+ 0° 62	15° 91	15° 79	- " 12
Apr.	6	8	11	8	47° 09	48° 30	+ 1° 21	13° 10	13° 04	- " 06
	12	9	16	18	36° 43	36° 96	+ 0° 53	12° 00	12° 01	+ " 01
	12	9	41	23	35° 72	35° 68	- 0° 04	11° 95	11° 92	- " 03
	15	9	20	56	212° 30	212° 11	- 0° 19	11° 19	11° 65	+ " 46

Observations of Jupiter's Sixth and Seventh Satellites from Photographs taken with the 30-inch Reflector of the Thompson Equatorial at the Royal Observatory, Greenwich.

(Communicated by the Astronomer Royal.)

The photographs were taken by Mr. Melotte, Mr. Davidson, or Mr. Edney. The measures of distance and position-angle from *Jupiter* are to be considered as merely provisional pending more complete measurements by the help of reference stars. The over-exposed image of *Jupiter* gave a reversed image in its centre suitable for measurement.

For more accurate measurement it is proposed to find the positions of the satellite in each case relatively to three or four faint comparison stars round it—the positions of these comparison stars relatively to 9 mag. reference stars being obtained from photographs with the Astrographic telescope, where the field sensibly free from distortion is much larger. The position of *Jupiter* will be determined from similar photographs with shorter exposures, the same stars being used as reference stars.

The provisional measures given below are not corrected for refraction and aberration. A comparison is given with Mr. F. E. Ross's Ephemerides, *A.N.* 4042 and *L.O.B.* No. 82.

Observations of Jupiter and Satellite VI.

Plate No.	Date.	G.M.T.	<i>p.</i>		<i>s.</i>		Tab.—Obs.		Exposure.
							<i>p.</i>	<i>s.</i>	
	1905.	h m	° '	' "	' "		° '	' "	m
2028	Aug. 23	13 30	311° 9	25' 30"	...	...	...	...	30
2029	23	14 23	310 45	25 33	...	...	...	...	31
2038	Sept. 3	15 17	290 51	36 59	+ 4° 8	- 0° 5	...	...	40
2047	7	13 26	286 54	40 52	3° 9	1° 0	...	...	60
2048	7	15 32	286 48	40 54	4° 0	1° 0	...	...	55
2050	8	12 56	285 54	41 43	3° 7	0° 9	...	...	30
2054	12	14 37	281 29	45 16	4° 0	1° 5	...	...	20
2055	12	15 5	281 26	45 17	+ 4° 0	- 1° 5	...	...	20

Plate No.	Date.	G.M.T.		p.	s.	Tab.—Obs.		Exposure.
		h	m			p.	s.	
2056	1905. Sept. 12	15	42	281° 32'	45' 17"	+ 4° 0'	— 1' 5"	30
2068	30	12	17	267 34	54 53	3' 2	0' 6	60
2070	Oct. 4	12	25	264 51	55 29	2' 8	0' 5	40
2072	4	16	38	264 41	55 31	2' 9	0' 5	39
2074	5	11	52	264 3	55 33	2' 7	0' 5	30
2075	5	13	7	264 10	55 34	2' 6	0' 6	59
2077	6	11	16	263 34	55 34	2' 4	— 0' 6	26
2079	21	10	55	251 38	51 54	1' 9	+ 0' 1	45
2080	21	11	54	251 37	51 53	1' 9	0' 1	45
2081	22	10	46	250 40	51 24	1' 8	0' 2	40
2082	22	12	4	250 44	51 24	1' 8	0' 2	75
2086	25	10	47	248 0	49 47	1' 5	0' 3	30
2087	25	11	47	248 0	49 45	1' 5	0' 3	60
2089 {	27	10	17	246 10	48 34	1' 3	0' 3	40
	27	10	58	246 10	48 33	1' 3	0' 3	29
2091	29	9	47	244 11	47 19	1' 3	0' 3	30
2092	29	10	20	244 8	47 16	1' 3	0' 3	25
2093	29	12	19	244 1	47 16	1' 3	0' 3	177
2094	29	14	17	243 59	47 9	1' 3	0' 3	17
2096 {	31	10	24	241 42	45 54	1' 3	0' 1	25
	31	10	48	241 42	45 54	1' 3	0' 1	20
2097	31	12	4	241 31	45 51	1' 3	+ 0' 1	84
2098	Nov. 3	9	49	238 9	43 46	1' 3	— 0' 2	30
2100	3	11	45	237 58	43 43	1' 3	0' 1	54
2104	6	10	19	233 51	41 32	1' 2	0' 3	15
2105	6	10	48	233 50	41 31	1' 2	0' 3	15
2106	6	11	50	233 53	41 27	1' 2	0' 3	70
2110	7	14	12	232 19	40 38	1' 4	0' 3	15
2111	7	15	14	232 9	40 33	+ 1' 3	— 0' 3	90

Observations of Jupiter and Satellite VII.

Plate No.	Date	G.M.T.		p.	s.	Tab.—Obs.		Exposure
		h	m			p.	s.	
2082	1905. Oct. 22	12	4	286° 15'	41' 55"	+ 1° 0'	+ 5' 6"	75
2093	29	12	19	286 29	31 44	0' 3	7' 6	177
2094	29	14	17	286 30	31 32	+ 0' 3	7' 6	17
2097	31	12	4	286 30	28 25	— 0' 5	8' 1	84
2100	Nov. 3	11	45	286 47	23 21	1' 9	8' 9	54
2106	6	11	50	287 15	18 4	3' 0	10' 0	70
2111	7	15	14	287 46	15 54	— 3' 7	+ 10' 8	90

*Observations of Phenomena of Jupiter's Satellites at Windsor,
New South Wales, in the years 1900 and 1902.* By John
Tebbutt.

Day of Observation.	Satel- lite.	Pheno- menon.	Phase.	Mag. Power.	G.M.T. of Observation. h m s	Mean Time of Nautical Almanac. h m s
1900.						
June 30	I.	Tr. Egr.	Int. contact	168	21 26 29	
30	I.	"	Bisection	"	21 28 39	21 31
30	I.	"	Ext. contact	"	21 30 54	
July 1	I.	Ecl. R.	First seen	74	19 32 48	19 33 17
1	I.	"	Full brightness	"	19 35 42	
13	III.	"	First seen	"	20 48 24	20 49 29
13	II.	Tr. Ingr.	Ext. contact	168	22 2 22	
13	II.	"	Bisection	"	22 4 47	21 58
13	II.	"	Int. contact	"	22 7 7	
15	I.	Occ. D.	First contact	"	20 9 2	
15	I.	"	Bisection	"	20 11 7	20 10
15	I.	"	Last seen	"	20 12 52	
15	I.	Ecl. R.	First seen	74	23 21 39	23 22 24
15	I.	"	Full brightness	"	23 25 14	
Sept. 17	II.	"	First seen	"	20 34 4	20 37 2
17	II.	"	Full brightness	"	20 38 59	
Oct. 1	I.	"	First seen	"	20 24 35	20 25 5
1	I.	"	Full brightness	"	20 28 9	
1902.						
Sept. 14	IV.	Occ. D.	First contact	168	23 9 39	
14	IV.	"	Bisection	"	23 13 38	23 21
14	IV.	"	Last seen	"	23 17 33	
14	I.	"	First contact	"	23 14 8	
14	I.	"	Bisection	"	23 15 53	23 16 0
14	I.	"	Last seen	"	23 18 22	
16	I.	Ecl. R.	First seen	74	20 58 30	20 58 50
16	I.	"	Full brightness	"	21 0 18	
19	II.	"	First seen	"	23 47 21	23 48 7
19	II.	"	Full brightness	"	23 50 23	
30	I.	Occ. D.	First contact	138	21 19 49	
30	I.	"	Bisection	"	21 22 9	21 22
30	I.	"	Last seen	"	21 23 58	
Oct. 4	III.	Tr. Ingr.	Ext. contact	"	22 18 1	
4	III.	"	Bisection	"	22 21 40	22 20
4	III.	"	Int. contact	"	22 25 29	
5	II	Tr. Egr.	Int. contact	"	21 41 0	

Day of Observation. 1902.	Satel- lite.	Pheno- menon.	Phase.	Mag. Power.	G.M.T. of Observation. h m s	Mean Time of Nautical Almanac. h m s
Oct. 5	II.	Tr. Egr.	Bisection	138	21 44 49	21 46
5	II.	"	Ext. contact	"	21 48 34	
7	I.	Occ. D.	First contact	168	23 11 11	
7	I.	"	Bisection	"	23 13 31	23 13
7	I.	"	Last seen	"	23 15 20	
8	I.	Tr. Ingr.	Ext. contact	"	20 21 7	
8	I.	"	Bisection	"	20 23 12	20 21
8	I.	"	Int. contact	"	20 25 7	
8	III.	Ecl. R.	First seen	"	20 56 9	20 58 48
8	I.	Tr. Egr.	Int. contact	"	22 36 59	
8	I.	"	Bisection	"	22 38 4	22 41
8	I.	"	Ext. contact	"	22 40 54	
9	I.	Ecl. R.	First seen	74	21 13 35	21 13 35
12	II.	Tr. Ingr.	Ext. contact	168	21 21 53	
12	II.	"	Bisection	"	21 23 33	21 19
12	II.	"	Int. contact	"	21 25 43	
13	II.	Tr. Egr.	Int. contact	"	0 11 0	
13	II.	"	Bisection	"	0 13 55	0 15
13	II.	"	Ext. contact	"	0 17 4	
14	II.	Ecl. R.	First seen	74	20 58 30	20 59 20
14	II.	"	Full brightness	"	21 3 4	
15	III.	Ecl. D.	Began to fade	168	21 21 14	
15	III.	"	Last seen	"	21 26 37	21 27 12
15	I.	Tr. Ingr.	Ext. contact	"	22 12 45	
15	I.	"	Bisection	"	22 14 25	22 13
15	I.	"	Int. contact	"	22 16 6	
16	I.	Tr. Egr.	Int. contact	"	0 29 7	
16	I.	"	Bisection	"	0 30 52	0 34
16	I.	"	Ext. contact	"	0 33 6	
16	III.	Ecl. R.	First seen	"	0 57 30	1 0 22
16	III.	"	Full brightness	"	1 3 51	
16	I.	"	First seen	74	23 8 22	23 8 56
16	I.	"	Full brightness	"	23 11 38	
19	II.	Tr. Ingr.	Ext. contact	168	23 53 57	
19	II.	"	Bisection	"	23 55 36	23 50
19	II.	"	Int. contact	"	23 58 1	
21	II.	Ecl. R.	First seen	74	23 37 3	23 37 10
21	II.	"	Full brightness	"	23 40 13	
Dec. 1	I.	"	First seen	43	23 38 14	23 38 18
1	I.	"	Full brightness	"	23 41 39	

Notes.

1900.

- June 30. Good definition and observations.
 July 1. Observation in partial twilight and unsatisfactory.
 13. Beautifully clear sky and good definition at the eclipse, but satellite detected rather late. Poor definition at the transit.
 15. Sky beautifully clear, and definition good throughout. Observations good.
 Sept. 17. Sky beautifully clear and observation good, but the twilight had not disappeared.
 Oct. 1. Sky beautifully clear, and definition good, but twilight strong. Satellite detected rather late.

1902.

- Sept. 14. Sky beautifully clear and definition pretty good. The contrast between the brightness and colour of the satellites was remarkable. While the first was very bright and of a yellowish colour up to contact, the fourth was remarkably dull and of a bluish tint.
 16. Sky beautifully clear and definition pretty good, but full Moon present. Satellite detected about a second late.
 19. Sky clear and definition good. The satellite was suspected a little earlier than the recorded time.
 30. Sky hazy, but images steady and pretty well defined.
 Oct. 4-5. Beautifully clear, definition good, and observations satisfactory. As the satellite would pass a little north of the centre of the disc I expected the usual dark transit, and was not disappointed. The satellite was seen with great difficulty as a bright spot in contact with the south edge of the great north equatorial belt at $22^h 38^m 7^s$. It then became invisible, and continued so till $22^h 49^m 35^s$, when it was suspected as a faint hazy spot. It gradually grew darker till the time of mid-transit, $0^h 15^m 21^s$, when it was very dark and well defined, but not so dark as the shadow in transit. I have seen the satellite darker.
 5. Satellite faint at first contact, definition good.
 7. Images steady and well defined, and observations good.
 8. Sky beautifully clear throughout; definition fair, but images tumulous at transit ingress. Definition fair and images steady at eclipse, but Moon present. When about one third of its way across the disc, satellite I. was seen as a faint hazy spot; it grew somewhat darker till $22^h 7^m 50^s$, and ceased to be visible at $22^h 18^m 33^s$. The definition at egress was not so good, and the internal contact was noted rather late.
 9. Sky beautifully clear.
 12-13. Images steady and well defined, particularly at ingress. The satellite was seen as a bright spot till $21^h 52^m 28^s$, when it became invisible. At $0^h 9^m 50^s$ it was again seen as a bright spot. No trace could be seen of it at mid-transit.
 14. Sky beautifully clear, but Moon very bright; images steady and well defined.
 15-16. Beautifully clear throughout, but full Moon present. The conjunction of satellites I. and III. in the plane of their motion occurred about $21^h 17^m 29^s$, but I think the observation was rather late; they appeared to be just in contact. The steadiness and definition at transit ingress were satisfactory. Satellite I. was seen as a bright spot till about $22^h 36^m 17^s$. At $22^h 59^m 43^s$ it became visible as a hazy spot. It was again invisible at $0^h 0^m 32^s$. Observation of the internal contact at egress was difficult owing to the faintness of the satellite, and the recorded time was rather late. Satellite III. suspected at $0^h 57^m 30^s$, but I was certain of it $28\frac{1}{2}$ seconds later. This satellite appeared bluish about three minutes before full brightness.

- Oct. 16. Sky clear near planet and definition good at reappearance of satellite I. The satellite was suspected at the recorded time, but I was certain of it 12½ seconds later.
19. Steadiness and definition very satisfactory.
21. Images steady and well defined, but sky very hazy.
- Dec. 1. Sky hazy near planet, which was rather low for good observation.

The observations of December 1 were made with the $4\frac{1}{2}$ -inch equatorial, and all the others with the 8-inch instrument. An occulting-bar was not employed in the eclipse observations, and the observations of full brightness are only rough approximations. The times given throughout are the Windsor mean times diminished by $10^h 3^m 20^s.5$, and entered to the nearest second. This communication contains all the phenomena of *Jupiter's* satellites observed here since those published for 1898 and 1899 in vol. ix. of the *Monthly Notices*.

Observatory, Peninsula, Windsor, N. S. Wales:
1905 October I.

*Results of Micrometer Measures of Double Stars made with the
28-inch Refractor at the Royal Observatory, Greenwich, in
the year 1904.*

(Communicated by the Astronomer Royal.)

The measures were made with a bifilar position-micrometer on the 28-inch refractor, focal length 28 feet. The power generally employed was 670, but when definition permitted a power of 1120 was employed for observing very close pairs. When bright stars were observed a blue glass shade was usually employed to diminish the light and irradiation. The observations were made in variously coloured fields or in a dark field with illuminated wires. The initials in the last column are those of the observers, viz. :

L. Mr. Lewis. H. F. Mr. Furner.
W. B. Mr. Bowyer.

On nights when the definition was not sufficiently good for measuring stars in the ordinary Working List, the time was spent in measuring stars from a Supplementary List, made up of Struve stars which have been neglected, or which require periodical observation at intervals of ten years or so, and of miscellaneous stars in which the companion is very faint. As measures of such pairs are not of immediate interest, a list only of the stars observed is given here, the publication of the measures, as well as of the individual results of the observations

of the other stars, being reserved for the volume of *Greenwich Observations* for 1904.

In general the present list of measures is confined to stars of which the separation is under 4'', or which show orbital movement.

Stars in the Supplementary List observed in 1904.

Struve Stars.

Σ 183	Σ 899	Σ 1375	Σ 2178	Σ 2395	Σ 2769
200	929	1421	2184	2428	2792
214	953	1443	2193	2429	2814
224	958	1459	2194	2450	2829
240	986	1555 A.C.	2198	2587	2834
260	1018	1835	2201	2615	2841
273	1027	2001	2225	2618	2861
412	1066	2006 A.C.	2225 ²	2621	2876
420	1174	2014	2226	2622	2895
444	1184	2016	2237	2628	2908
449	1200	2029	2255	2631	2910
450	1204	2030	2263	2633	2931
452	1212	2043	2265	2634	2941
458	1218	2072	2266	2635	2945
524	1220	2076	2283	2639	2949
529	1237	2079	2304	2663	2957
582	1239	2085	2313	2664	2967
603	1246	2087	2319	2680	2978
616	1251	2102	2321	2691	3006
625	1259	2103	2322	2704 A.C.	3007
662	1262	2135	2329	2704 A.D.	3021
669	1274	2147	2333	2718	3024
674	1278	2164	2335	2725	3040
680	1288	2172	2336	2731	3042
683	1293	2174	2341	2747	3043
706	1297	2175	2345	2759	3044
718	1301	2176	2351	2760	3048
877	1321	2177	2385	2761	3058

Otto Struve Stars.

OS 230, 304 and 444.

Hough Stars.

Ho. 67, 84, 252, 259, 377, 551, 557, 582.

Burnham, 45.

Micrometric Observations of Double Stars at the Royal Observatory, Greenwich.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. °	Position Angle. '	Dis- tance. "	No. of Nights.	Mags.	Epoch 1904.	Obs.
Σ 3060...	0 1	72 29	121.6	3.72	2	8.5 8.7	.946	W.B.
A.G. 56	0 12	68 47	132.2	2.11	1	8.9 9.4	.841	W.B.
Σ 25 ...	0 14	74 34	191.4	1.44	1	8.5 8.5	.841	W.B.
Σ 67 ...	0 47	79 56	358.7	1.93	1	8.3 9.0	.841	W.B.
Σ 73 ...	0 50	66 55	24.4	0.95	3	6.2 6.8	.591	W.B.
			25.7	0.81	1	...	.865	H.F.
Σ 137 ...	1 30	59 14	88.3	3.38	1	8.2 9.0	.088	W.B.
Σ 138 ...	1 31	82 52	40.1	1.52	2	7.3 7.3	.882	W.B.
			37.1	1.28	1	...	.865	H.F.
Σ 140 ...	1 33	49 25	175.1	3.54	2	8.5 9.2	.091	W.B.
Σ 178 ...	1 47	79 41	199.7	3.28	1	7.8 7.8	.865	H.F.
β 260 ...	1 48	75 3	235.8	0.75	1	8.3 8.9	.865	H.F.
Σ 194 ...	1 54	65 39	269.9	1.23	1	8.0 8.3	.969	W.B.
OΣ 38 ...	1 58	48 9	113.4	...	1	5.0 6.2	.123	L.
Σ 205 ...	1 58	48 9	63.1	10.21	1	3.0 5.0	.123	L.
Σ 208 ...	1 58	64 33	87.5	0.55	2	6.2 8.4	.529	W.B.
			79.0	0.71	1	...	.096	H.F.
Σ 226 ...	2 7	66 30	247.0	2.22	1	7.8 9.7	.088	W.B.
Σ 269 ...	2 22	60 34	340.6	1.95	1	7.5 9.8	.969	W.B.
Σ 305 ...	2 42	71 3	314.9	3.03	4	7.3 8.2	.031	W.B.
			314.7	2.93	1	...	.096	H.F.
Σ 333 ...	2 54	69 4	201.6	1.23	3	5.7 6.0	.023	W.B.
			207.0	1.48	1	...	.096	H.F.
Σ 346 ...	3 0	65 8	88.4	0.45	2	6.0 6.0	.504	W.B.
			94.7	0.54	1	...	.096	H.F.
A.C. ...			356.8	5.22	1	6.0 10.8	.096	H.F.
Σ 352 ...	3 3	54 56	359.1	3.64	2	8.2 10.3	.178	W.B.
Σ 375 ...	3 15	66 40	315.0	2.41	1	8.0 10.1	.131	W.B.
Σ 384 ...	3 20	30 27	269.2	1.82	1	7.8 9.0	.192	W.B.
Σ 389 ...	3 22	30 59	59.4	2.65	1	7.0 8.0	.192	W.B.
Σ 395 ...	3 23	61 17	104.0	1.83	1	8.5 10.0	.129	L.
β 533 ...	3 29	58 39	53.8	0.57	1	7.5 7.5	.129	L.
Σ 425 ...	3 34	56 10	271.1	2.42	2	7.3 7.3	.039	W.B.
β 535 ...	3 38	58 2	55.8	1.00	1	3.8 8.5	.129	L.
Σ 438 ...	3 38	67 35	242.7	1.86	1	8.5 10.5	.129	L.
Σ 442 ...	3 39	67 36	259.8	2.97	1	9.0 9.5	.129	L.
β 537 ...	3 41	65 28	201.2	0.86	1	8.4 9.8	.126	L.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° ' "	Position Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
β 537 ...	3 41	65 28	188°0	1'05	1	8.4 9.8	'131	W.B.
Ho. 324 ...	3 43	75 18	337'9	0'64	1	8.1 8.3	'022	W.B.
Σ 457 ...	3 44	67 37	103'0	1'12	1	8.8 8.8	'123	L.
Hu. 24... ..	3 52	78 48	273'8	1'10	1	8.5 11.3	'123	L.
Hu. 25... ..	3 53	78 10	321'6	0'75	1	8.6 9.1	'123	L.
Σ 483 ...	3 57	50 46	234'0	0'43	1	7.4 9.2	'129	L.
			239'2	0'57	1	...	'131	W.B.
Σ 522 ...	4 15	38 38	210'0	1'55	1	8.5 8.5	'164	W.B.
O Σ 80 ...	4 17	47 49	189'5	0'45	1	6.5 7.0	'131	W.B.
Σ 535 ...	4 18	78 51	327'2	1'60	2	6.7 8.2	'030	W.B.
			329'2	1'38	1	...	'096	H.F.
Σ 553 ...	4 25	39 9	132'0	3'06	1	8.0 8.5	'164	W.B.
Σ 567 ...	4 31	70 43	318'2	1'99	2	8.5 9.0	'036	W.B.
			322'2	1'93	1	...	'096	H.F.
O Σ 86 ...	4 31	70 27	67'8	0'49	1	7.5 7.5	'036	L.
Σ 572 ...	4 32	63 15	201'4	3'80	4	6.5 6.5	'037	W.B.
			201'8	3'56	2	...	'069	H.F.
β 1238... ..	4 55	63 36	12'4	1'41	2	8.1 11.5	'166	L.
Hu. 445 ...	4 56	69 19	290'4	0'47	1	8.5 8.8	'208	L.
Hu. 446 ...	5 1	67 24	180'6	0'83	1	9.2 9.8	'208	L.
Σ 645 A. & $\frac{B.C.}{2}$	5 3	62 6	25'6	11'81	2	6.2 8.2	'175	L.
β 1047 B.C. ...			54'5	0'49	1	8.2 8.8	'208	L.
O Σ 103 ...	5 12	56 44	57'6	4'22	1	5.2 11.0	'206	L.
β 886 C.D. ...	5 16	56 18	247'5	0'92	1	9.2 10.0	'219	L.
Σ 687 A.B. ...			68'2	17'27	1	8.2 9.0	'219	L.
β 888 ...	5 18	52 42	170'3	8'60	1	6.0 12.0	'219	L.
Σ 715 A.B. ...	5 23	48 48	200'1	0'63	1	8.2 8.9	'219	L.
			51'0	19'45	1	8.2 11.5	'219	L.
Σ 719 A.C. ...	5 24	60 32	351'4	15'01	1	7.0 8.9	'118	W.B.
			349'5	15'14	1	...	'183	H.F.
A.B. ...			328'9	0'82	1	7.0 9.5	'183	H.F.
Σ 749 ...	5 31	63 8	168'9	0'79	2	7.0 7.1	'036	W.B.
Σ 778 ...	5 38	59 7	184'0	3'09	1	7.7 9.0	'203	W.B.
Σ 821 ...	5 52	60 22	0'3	2'29	1	8.0 9.8	'205	W.B.
Σ 867 ...	6 6	72 34	154'3	2'13	1	7.0 8.6	'203	L.
Σ 881 ...	6 13	30 35	103'2	0'87	1	6.4 7.9	'274	L.
Σ 888 A.C. ...	6 14	61 32	251'9	3'04	2	7.5 9.2	'076	W.B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Posi- tion Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
	h m	° '	°	"				
Σ 899 ...	6 17	72 23	21°5	2'18	2	7'0 8'0	'036	W.B.
OΣ 149 ...	6 30	62 38	260°2	1'47	1	6'5 9'0	'219	L.
Σ 936 ...	6 31	31 49	273°3	1'29	1	7'0 8'7	'274	L.
Σ 942 ...	6 32	66 16	244°8	3'87	2	9'0 9'2	'289	W.B.
Σ 945 ...	6 33	48 56	272°8	0'84	1	7'1 8'0	'274	L.
Σ 946 ...	6 36	30 24	126°8	3'96	1	7'1 9'0	'274	L.
Σ 948 A.B. ...	6 37	30 28	116°0	1'41	1	5'2 6'1	'274	L.
A.C. ...			305°8	8'23	1	5'2 7'4	'274	L.
A.G.C. 1 Sirius	6 41	106 34	112°9	5'82	1	—1'4 10'0	'186	L.
Σ 964 ...	6 43	46 8	193°2	1'83	1	8'3 9'0	'205	W.B.
Σ 991 ...	6 51	64 50	168°9	3'74	1	8'0 9'0	'219	L.
Σ 1001 A.B. ...	6 55	35 41	64°6	9'05	1	7'1 8'7	'274	L.
B.C. ...			357°0	1'45	1	8'7 9'0	'274	L.
Σ 1008...	6 56	63 15	272°6	2'53	2	8'0 10'0	'300	W.B.
Σ 1024...	7 3	51 41	316°0	1'28	2	8'3 8'8	'294	W.B.
Σ 1037...	7 7	62 36	295°6	0'75	2	7'1 7'1	'162	W.B.
			303°0	0'71	1	...	'183	H.F.
Σ 1070...	7 15	55 46	323°5	2'04	1	8'2 9'2	'279	W.B.
Σ 1074 A.B. ...	7 15	89 25	146°0	0'43	1	7'8 8'2	'192	L.
A.C. ...			104°2	12'12	1	7'8 13'0	'192	L.
A.D. ...			12°6	16'05	1	7'8 13'0	'192	L.
Ho. 243 ...	7 16	60 33	168°9	2'81	1	9'3 9'5	'219	L.
Σ 1079 A.B. ...	7 18	51 57	331°7	5'87	1	8'5 10'0	'290	W.B.
C.D. ...			63°1	2'05	1	9'5 9'5	'290	W.B.
Berlin (B.) 2941	7 20	67 43	174°3	2'06	1	8'7 10'3	'186	L.
Σ 1093...	7 23	39 49	147°0	0'54	3	8'2 8'2	'296	W.B.
Σ 1110...	7 28	57 53	223°9	5'67	2	2'7 3'7	'161	W.B.
Procyon ...	7 34	84 31	355°2	4'93	2	1'0 9'0	'294	W.B.
Σ 1126...	7 35	84 32	149°9	1'12	1	7'2 7'5	'183	H.F.
			146°9	1'01	1	...	'192	W.B.
			144°8	1'00	1	...	'219	L.
Ho. 247 ...	7 40	68 42	107°4	0'39	1	7'5 8'0	'263	W.B.
Σ 1147...	7 44	65 13	164°7	2'42	1	9'0 9'0	'279	W.B.
Σ 1165...	7 54	35 7	274°5	0'58	1	8'0 10'3	'290	W.B.
Σ 1172...	7 57	34 59	244°0	1'68	1	7'6 9'4	'290	W.B.
β 581 $\frac{A.B.}{2}$ & C.	7 59	77 26	194°4	4'69	1	8'3 11'0	'312	L.
Σ 1187...	8 3	57 29	44°1	2'29	2	7'1 8'0	'199	W.B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
	h m	° '	° '	"				
Σ 1187... ..	8 3	57 29	46° 1	2° 17	2	7.1 8.0	257	L.
Σ 1196 A.B. ...	8 6	72 3	351° 5	1° 11	3	5.0 5.7	252	W.B.
			355° 0	0° 88	1	...	288	H.F.
A.C. ...			110° 2	5° 43	3	5.0 6.5	252	W.B.
B.C. ...			122° 6	6° 08	2	5.7 6.5	228	W.B.
$\frac{A.B.}{2}$ & C.			118° 3	5° 66	1	5.0 6.5	301	W.B.
Σ 1197... ..	8 7	60 8	105° 0	1° 71	1	8.2 9.0	295	L.
Σ 1202... ..	8 8	78 51	315° 3	2° 53	1	7.7 9.8	192	W.B.
Ho. 524 ...	8 10	71 0	340° 1	3° 80	1	8.0 11.0	312	L.
Σ 1211... ..	8 12	50 42	126° 2	1° 06	1	8.7 9.2	295	L.
Ho. 525 ...	8 17	69 40	147° 5	0° 47	1	8.5 8.5	241	W.B.
			161° 2	0° 61	2	...	308	L.
Σ 1225... ..	8 22	38 29	192° 8	3° 75	1	8.5 8.5	298	W.B.
Σ 1235... ..	8 26	32 44	85° 1	1° 24	1	8.0 10.0	337	W.B.
Σ 1242... ..	8 29	42 32	175° 1	2° 60	1	8.6 9.3	295	L.
Σ 1244... ..	8 31	47 51	1° 0	3° 68	1	8.2 9.8	295	L.
Berlin (B.) 3449	8 31	66 24	6° 1	1° 74	1	9.2 10.2	304	L.
β 585 ...	8 35	69 10	103° 0	0° 47	2	7.7 9.0	308	L.
Ho. 354 ...	8 37	63 35	182° 8	1° 00	2	8.2 8.8	247	L.
β 209 ...	8 37	50 50	181° 9	1° 51	1	8.2 8.7	295	L.
Ho. 251 ...	8 40	64 19	154° 5	4° 01	1	8.5 12.2	304	L.
Σ 1273 A.B. ...	8 41	83 13	147° 1	0° 23	2	3.8 6.0	245	L.
			144° 2	0° 25	2	...	294	W.B.
$\frac{A.B.}{2}$ & C.			236° 0	3° 40	3	3.8 7.7	260	W.B.
			231° 7	3° 58	3	...	264	L.
Σ 1279... ..	8 43	50 3	268° 1	1° 38	1	8.3 8.3	295	L.
Σ 1275... ..	8 44	32 6	14° 4	1° 97	1	8.0 8.0	312	L.
Ho. 40... ..	8 45	58 13	286° 5	0° 69	1	9.0 9.3	312	L.
Berlin (B.) 3559	8 45	66 30	74° 1	1° 98	1	9.0 9.1	304	L.
Σ 1289... ..	8 48	46 2	4° 4	3° 90	1	7.0 8.5	301	W.B.
Σ 3121... ..	9 12	61 0	26° 9	0° 49	3	7.5 7.8	273	W.B.
			18° 6	0° 75	11	...	304	L.
Ho. 43... ..	9 13	68 47	283° 4	0° 46	1	8.0 8.5	241	W.B.
OΣ 201 ...	9 18	61 39	226° 0	1° 49	2	7.5 9.0	232	W.B.
			218° 1	1° 64	1	...	312	L.
Σ 1348... ..	9 19	83 13	317° 8	1° 78	1	7.5 7.6	192	W.B.
Σ 1374... ..	9 35	50 35	287° 9	3° 46	1	7.0 8.3	342	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
	h m	° '	° '	"				
Σ 1374...	9 35	50 35	288° 5'	2' 94"	1	7'0 8'3	'383	W.B.
Σ 1389...	9 47	62 32	311° 8'	2' 20"	2	8'0 9'0	'291	W.B.
W.B. (2) X 128-9	10 9	71 38	9'0	1' 34"	2	8'0 8'5	'252	W.B.
			6'7	1' 57"	1	...	'312	L.
OΣ 215	10 11	71 46	210° 5'	0' 79"	3	7'0 7'2	'261	W.B.
			206° 6'	0' 83"	1	...	'288	H.F.
Σ 1424...	10 14	69 39	116° 9'	3' 54"	1	2'0 3'5	'301	W.B.
			117° 9'	3' 81"	1	...	'312	L.
OΣ 217	10 21	72 16	146° 7'	0' 85"	2	7'3 7'8	'271	W.B.
Σ 1426 A.B.	10 15	83 4	286° 3'	0' 71"	1	7'5 8'0	'288	H.F.
Σ 1429...	10 20	64 53	256° 0'	1' 06"	3	8'3 8'3	'277	W.B.
Σ 1457...	10 34	83 46	317° 7'	1' 15"	1	7'6 8'5	'288	H.F.
OΣ 228	10 42	66 54	193° 2'	0' 45"	1	7'2 8'1	'263	W.B.
OΣ 229	10 42	48 21	320° 4'	0' 78"	2	6'7 7'1	'315	W.B.
			315° 0'	0' 86"	1	...	'312	L.
Ho. 48...	10 59	66 18	5° 8'	1' 63"	1	8'3 11'0	'263	W.B.
			8° 8'	1' 58"	2	...	'389	L.
Σ 1504...	10 59	85 49	291° 1'	0' 96"	1	7'5 7'6	'288	H.F.
Ho 378	10 59	51 2	43° 6'	0' 25"	1	8'0 8'1	'397	L.
Σ 1517...	11 8	69 19	265° 0'	0' 52"	4	7'3 7'3	'268	W.B.
			267° 3'	0' 43"	2	...	'389	L.
Lal. 21846	11 24	58 59	7° 6'	1' 08"	2	7'0 11'5	'389	L.
OΣ 234	11 25	48 10	136° 0'	0' 28"	1	7'0 7'5	'340	W.B.
			146° 8'	0' 32"	2	...	'389	L.
Ho. 51...	11 27	81 34	181° 9'	2' 89"	2	7'0 11'5	'389	L.
Σ 1554...	11 31	76 36	256° 3'	0' 93"	1	8'8 8'8	'337	W.B.
Σ 1555 A.B.	11 31	61 40	349° 5'	0' 31"	2	6'4 6'8	'315	W.B.
			349° 1'	0' 36"	2	...	'389	L.
OΣ 237	11 34	48 18	260° 8'	1' 20"	2	7'5 9'0	'389	L.
Σ 1586...	11 52	49 6	259° 4'	1' 62"	1	8'3 11'0	'380	L.
Σ 1606...	12 6	49 33	329° 0'	1' 17"	2	6'3 7'0	'389	L.
			334° 2'	1' 58"	1	...	'460	H.F.
Ho. 536	12 16	54 26	102° 8'	3' 63"	1	8'5 9'7	'397	L.
Σ 1639...	12 19	63 52	3° 9'	0' 45"	1	6'7 7'9	'359	L.
			356° 0'	0' 35"	2	...	'428	W.B.
Ho. 53...	12 19	75 30	295° 5'	2' 34"	1	8'3 11'0	'337	W.B.
Σ 1643...	12 22	62 25	40° 6'	2' 34"	2	8'7 9'2	'300	W.B.
			38° 7'	1' 99"	1	...	'359	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Dis- tance.	No. of Nights	Mags.	Epoch 1903.	Obs.
	h m	° '	° '	"				
Σ 1647...	12 25	79 44	45° 3'	1' 55"	2	7·5 7·8	'300	W.B.
B.D + 2° 2550	12 26	87 20	289° 0'	1' 44"	1	8·5 8·8	'337	W.B.
B.D + 23° 2471	12 28	66 26	136° 0'	1' 15"	1	8·8 9·0	'359	L.
Hu. 571	12 28	69 27	76° 0'	0·29	1	8·8 8·8	'359	L.
Σ 1658...	12 30	82 0	0° 6'	2' 38"	1	8·5 10·0	'337	W.B.
Ho. 537	12 30	55 17	185° 1'	1 03	1	8·0 10·0	'397	L.
Σ 1661...	12 31	78 3	239° 6'	2' 56"	2	8·5 8·5	'300	W.B.
Σ 1663...	12 32	68 15	99° 9'	0·62	2	7·8 8·7	'300	W.B.
			100° 0'	0·75	1	...	'359	L.
Ho. 256	12 39	53 41	108° 7'	0·70	1	7·0 9·0	'397	L.
Σ 1687...	12 48	63 13	81° 1'	1' 25"	1	5·0 7·8	'422	W.B.
			79° 2'	1' 58"	1	...	'460	H.F.
Ho. 538	12 52	68 27	121° 0'	2' 55"	1	8·7 12° 0'	'422	W.B.
Σ 1711...	12 58	75 59	347° 0'	0·82	3	8·5 9·0	'404	W.B.
Ho. 257	13 1	63 34	154° 5'	2' 24"	3	8·8 8·9	'404	W.B.
* near OΣ 260	13 2	62 31	194° 7'	0·51	2	9·0 9·5	'454	W.B.
OΣ 260...	13 3	62 31	119° 7'	0·50	2	7·9 8·3	'418	W.B.
Hu. 572	13 4	68 1	352° 0'	0·43	3	8·0 9·0	'442	W.B.
Σ 1728...	13 5	71 57	196° 5'	0·36	2	6·0 6·0	'395	W.B.
			199° 2'	0·47	1	...	'460	H.F.
OΣ 261...	13 7	57 23	344° 9'	1' 60"	2	6·9 7·4	'449	W.B.
			347° 2'	1' 50"	1	...	'460	H.F.
β 800 ...	13 12	72 27	109° 6'	3' 04"	2	7·1 10° 2'	'418	W.B.
Σ 1734...	13 16	86 32	190° 7'	1' 28"	2	7·2 7·9	'373	W.B.
Σ 1742...	13 19	88 5	351° 7'	1' 17"	2	7·4 7·9	'373	W.B.
Ho. 260	13 19	60 15	326° 3'	0·86	1	8·3 8·5	'359	L.
			324° 1'	0·90	2	...	'454	W.B.
Berlin (B.) 4789	13 22	69 1	302° 6'	1' 69"	2	9·1 9·5	'419	W.B.
β 113 ...	13 24	78 0	213° 1'	1' 19"	1	8·5 10° 2'	'460	H.F.
Σ 1757...	13 29	89 48	79° 9'	2' 69"	2	7·8 8·9	'373	W.B.
Σ 1768...	13 33	53 13	133° 4'	1' 11"	2	5·7 7·6	'418	W.B.
β 801 ...	13 42	78 40	326° 5'	2' 63"	1	8·1 10° 9'	'460	H.F.
Σ 1785...	13 45	62 31	293° 4'	1' 58"	2	7·2 7·5	'423	W.B.
Σ 1808...	14 6	62 56	76° 6'	2' 80"	2	8·0 9·0	'373	W.B.
OΣ 278...	14 8	45 1	94° 5'	0·25	3	7·5 7·5	'460	W.B.
Ho. 57 B.C.	14 9	47 7	319° 2'	0·77	2	8·0 13° 0'	'389	L.
Σ 1819...	14 10	86 24	355° 5'	1' 31"	1	7·9 8·0	'367	W.B.
Ho. 545	14 30	59 44	317° 2'	0·65	3	8·3 8·3	'465	W.B.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. °	Position Angle. °	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
Σ 1865...	14 36	75 51	145° 7'	0.36"	3	3.5 3.9	466	W.B.
Σ 1867...	14 36	58 17	13° 8'	1.26	4	7.7 8.2	453	W.B.
			17.6	1.23	1	...	460	H.F.
Σ 1877...	14 41	62 30	326.4	2.86	2	3.0 6.3	373	W.B.
OΣ 285...	14 42	47 11	125.1	0.33	3	7.1 7.6	494	W.B.
Ho. 263	14 43	65 30	177.2	0.97	1	7.0 10.0	509	W.B.
Σ 1883...	14 44	83 37	243.3	0.45	3	7.0 7.0	471	W.B.
Σ 1888...	14 47	70 29	180.4	2.70	2	4.7 6.6	373	W.B.
OΣ 287...	14 48	44 40	320.2	0.72	3	7.5 7.6	494	W.B.
β 31 A.B.	14 48	70 51	193.5	1.57	3	8.4 9.7	500	W.B.
Ho. 389	14 48	69 18	95.7	1.60	2	7.0 9.3	462	W.B.
OΣ 288...	14 49	73 53	188.7	1.78	2	6.4 7.1	373	W.B.
Σ 1908...	15 1	55 9	147.5	1.72	2	8.2 9.2	496	W.B.
Ho. 60...	15 10	54 44	36.5	0.32	2	7.5 7.6	548	W.B.
			29.9	0.49	1	...	545	L.
* following Ho. 60	15 10	54 44	59.7	0.11	1	...	490	W.B.
Σ 1932...	15 14	62 48	156.9	0.57	3	5.6 6.1	434	W.B.
Ho. 264	15 17	73 8	323.3	1.16	2	8.0 12.0	538	L.
Hu. 146	15 17	68 35	171.9	0.42	2	8.7 9.0	538	L.
Ho. 62...	15 17	54 40	285.0	1.29	2	8.2 8.3	492	W.B.
Σ 1937...	15 19	59 21	16.7	0.93	3	5.2 5.7	466	W.B.
Σ 1938...	15 21	52 18	67.2	1.20	2	6.7 7.3	459	W.B.
Σ 1940...	15 21	71 30	324.9	1.13	2	8.2 8.7	548	L.
Aitken 82	15 23	65 44	320.0	0.79	2	8.5 9.3	519	L.
Hu. 577	15 28	69 55	24.7	0.38	2	8.0 8.0	538	L.
Σ 1954...	15 30	79 7	183.9	3.74	1	3.0 4.0	367	W.B.
			189.2	4.02	1	...	460	H.F.
			189.3	3.94	1	...	468	L.
OΣ 298...	15 33	49 52	187.4	1.34	2	7.0 7.3	486	W.B.
Hu. 580	15 37	70 0	71.0	0.27	3	5.0 5.0	466	W.B.
β 619 ...	15 39	76 2	7.2	0.47	2	6.5 7.0	519	L.
			2.5	0.45	2	...	496	W.B.
Σ 1967...	15 39	63 23	122.4	0.48	2	4.0 7.0	496	W.B.
OΣ 303...	15 56	76 27	141.9	0.77	3	7.4 7.9	500	W.B.
Σ 2006 A.B.	16 0	30 47	202.2	1.76	1	7.5 9.2	586	L.
Σ 2011...	16 4	60 44	72.2	2.21	1	7.2 9.8	608	W.B.
* near Ho. 551	16 9	63 5	142.9	2.61	2	7.0 11.5	560	L.
Σ 2021...	16 9	76 12	335.5	3.86	1	6.7 6.9	378	W.B.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° ' "	Posi- tion Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
Σ 2021 ..	... 16 9	76 12	334° 9'	3' 89"	1	6·7 6·9	'468	L.
Σ 2027...	... 16 10	85 29	79° 8'	1' 68"	1	8·2 8·2	'610	H.F.
Σ 2026...	... 16 11	82 23	205° 3'	0' 77"	2	8·6 9·1	'560	L.
Σ 2035...	... 16 14	63 54	35° 3'	2' 46"	1	8·7 10·9	'608	W.B.
Hu. 481	... 16 17	...	229° 5'	0' 50"	4	...	'511	W.B.
			227° 3'	0' 35"	1	...	'525	L.
Hu. 482	... 16 18	...	23° 4'	0' 52"	2	...	'538	L.
Hu. 483	... 16 23	...	205° 6'	0' 26"	2	...	'560	L.
Σ 2052...	... 16 25	71 23	90° 6'	1' 60"	1	7·5 7·5	'378	W.B.
			89° 9'	1' 57"	1	...	'468	L.
Σ 2055 λ Ophiuchi	16 26	87 48	58° 6'	1' 30"	2	4·0 6·1	'463	W.B.
OΣ 313	... 16 29	49 40	337° 0'	0' 75"	1	7·2 7·8	'660	L.
Σ 2062...	... 16 30	81 7	116° 8'	2' 50"	1	8·3 10·0	'610	H.F.
Σ 2067...	... 16 30	50 52	300° 1'	2' 59"	1	8·5 10·0	'586	L.
Hu. 486	... 16 35	67 4	144° 3'	1' 16"	3	9·0 10·0	'540	L.
Σ 2084...	... 16 38	58 13	190° 2'	1' 36"	3	3' 0 6·5	'514	W.B.
			190° 6'	0' 98"	1	...	'550	L.
Σ 2089...	... 16 39	64 42	61° 6'	2' 52"	1	8' 0 11·5	'525	L.
Σ 2091...	... 16 39	48 37	300° 5'	0' 84"	1	7·5 8' 0	'659	L.
Σ 2094...	... 16 40	66 18	73° 3'	1' 51"	1	7·3 7·6	'525	L.
De. 15 ...	... 16 41	46 20	307° 6'	0' 68"	1	8·2 8·6	'659	L.
β 43 ...	... 16 43	87 5	245° 6'	0' 90"	1	8·2 8·3	'556	H.F.
Hu. 666	... 16 43	66 49	200° 2'	0' 62"	1	8·7 12·5	'550	L.
OΣ 315...	... 16 46	88 37	158° 5'	0' 70"	1	6·2 8·1	'556	H.F.
Σ 2107...	... 16 48	61 10	344° 7'	0' 40"	3	6·5 8' 0	'522	W.B.
Σ 3107...	... 16 54	85 53	95° 1'	1' 58"	1	8·5 8·5	'468	L.
Σ 2117...	... 16 56	38 3	102° 7'	1' 57"	1	8·4 10·6	'586	L.
Σ 2114...	... 16 57	81 24	161° 7'	1' 19"	2	6·2 7·4	'519	L.
			163° 5'	0' 97"	1	...	'556	H.F.
Ho. 411	... 16 59	66 9	268° 9'	1' 39"	1	8·3 12·0	'468	L.
Σ 2121...	... 17 0	47 57	147° 0'	2' 76"	1	8' 0 10·0	'586	L.
Ho. 555	... 17 1	56 38	186° 6'	1' 67"	2	9·5 9·5	'558	L.
Σ 2133...	... 17 6	40 7	199° 6'	3' 39"	1	9' 0 10·5	'586	L.
Σ 2140 α Herculis	17 10	75 30	114° 8'	4' 77"	1	3' 0 6·1	'468	L.
			111° 4'	4' 81"	2	...	'526	W.B.
Σ 2145 A.C.	... 17 13	63 18	181° 0'	13' 40"	2	8' 0 9·5	'498	L.
			179° 8'	13' 54"	1	...	'531	W.B.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° '	Position Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
Σ 2145 A.B. ...	17 13	63° 18'	52° 1'	0·43"	2	8·3 8·9	'498	L.
			44° 1'	0·38	2	...	'542	W.B.
β 628 ...	17 15	57 14	347·9	0·48	1	9·0 9·5	'568	L.
β 629 ...	17 15	57 50	338·9	0·94	1	8·2 9·0	'685	L.
Ho. 415 ...	17 19	64 9	328·1	1·48	2	8·0 8·7	'492	W.B.
Ho. 414 ...	17 19	63 49	87·5	0·69	2	8·4 8·8	'515	W.B.
			84·1	0·55	1	...	'525	L.
β 46 ...	17 19	76 31	198·3	1·97	2	8·0 11·0	'526	W.B.
Hu. 671 ...	17 20	68 0	266·0	0·43	3	8·4 9·0	'566	W.B.
Σ 2163...	17 20	47 47	92·7	1·53	1	9·2 9·2	'660	L.
β 1250...	17 21	59 9	72·3	1·91	3	9·4 9·5	'537	W.B.
			70·6	2·40	1	...	'545	L.
Σ 2173...	17 25	90 59	325·2	0·82	1	5·8 6·1	'537	H.F.
β 631 ...	17 35	90 36	54·9	0·46	1	7·5 7·6	'537	H.F.
Σ 2196...	17 37	68 48	262·3	3·66	2	9·2 11·2	'611	W.B.
β 1251...	17 38	74 0	61·6	1·27	3	6·0 11·5	'586	W.B.
Σ 2203...	17 38	48 18	317·0	0·65	1	7·5 7·8	'660	L.
Σ 2210...	17 40	40 57	122·2	3·25	1	8·5 10·0	'660	L.
Ho. 560 ...	17 40	56 0	94·7	0·52	3	8·0 8·0	'586	W.B.
Σ 2205...	17 40	72 14	306·9	2·06	2	8·3 8·7	'483	W.B.
Σ 2214 B.C. ...	17 40	46 13	149·3	1·56	1	8·8 10·3	'660	L.
A.B. ...			211·3	19·90	1	8·5 8·8	'660	L.
Σ 2215...	17 41	72 15	288·4	0·91	2	5·9 7·9	'483	W.B.
Ho. 70...	17 42	59 26	104·6	0·47	3	8·1 8·1	'586	W.B.
A.C. 7 ...	17 43	62 13	68·0	1·60	2	9·5 11·0	'573	W.B.
Σ 2236...	17 47	54 32	94·2	3·29	1	7·8 9·8	'690	H.F.
			96·1	2·88	1	...	'685	L.
OΣ 338...	17 47	74 39	19·3	0·65	3	6·6 6·9	'483	W.B.
Σ 2238...	17 47	52 17	285·6	2·24	1	9·2 9·7	'690	H.F.
			283·7	2·88	1	...	'685	L.
Aitken 234 ...	17 49	64 23	28·6	0·35	1	8·8 9·1	'674	W.B.
A.C. 9 ...	17 50	60 10	59·3	1·16	3	8·3 8·7	'518	W.B.
Ho. 73...	17 54	54 18	39·8	2·10	1	9·0 9·0	'679	L.
Ho. 74...	17 55	56 30	30·7	2·99	1	8·7 12·7	'660	L.
Σ 2262...	17 58	98 11	258·6	1·56	2	5·0 5·7	'547	H.F.
Σ 2267...	17 58	49 49	247·3	1·08	1	8·0 8·0	'452	L.
Σ 2272...	18 0	87 28	188·9	1·98	11	4·1 6·1	'528	W.B.
OΣ 341 ...	18 2	68 34	88·4	0·44	1	6·4 7·7	'537	H.F.

Star's Name.	R.A. 1900.		N.P.D. 1900.		Position Angle.	Dis- tance.	No. of Nights.	Mags.		Epoch 1903.	Obs.
	h	m	°	'							
OΞ 341... ..	18	2	68	34	87°6	0'40	2	6·4	7·7	'573	W.B.
Ξ 2282... ..	18	3	49	39	271°5	2'50	1	7·2	8·2	'454	L.
Ξ 2281... ..	18	5	86	1	237°7	0'34	2	6·7	7·2	'545	W.B.
					232°0	0'53	1	...		'557	H.F.
Ξ 2289... ..	18	6	73	32	233°5	1'29	2	6·0	7·1	'485	W.B.
Ξ 2298... ..	18	9	48	37	180°6	2'30	1	8·5	9·7	'690	H.F.
Ξ 2296... ..	18	10	93	23	7°0	3'21	1	6·7	10·3	'613	W.B.
B.D. + 21° 3386	18	16	68	43	190°8	1'43	4	9·0	9·2	'564	W.B.
					190°8	1'47	1	...		'539	H.F.
A.C.					9°5	13'24	2	9·0	12°0	'559	W.B.
Ho. 430	18	17	69	33	193°0	2'44	3	8·5	9°0	'535	W.B.
B 641	18	18	68	32	344°0	1'11	2	7·5	9°0	'526	W.B.
Ξ 2320... ..	18	24	65	25	7°4	1'53	2	7·1	9°0	'526	W.B.
Ξ 2324... ..	18	26	88	44	323°5	2'29	1	8·2	8·5	'695	L.
Ξ 2328... ..	18	26	60	8	72°5	3'64	1	8°0	8·3	'707	H.F.
OΞ 354	18	27	83	17	174°7	0'91	1	7·2	8°0	'695	L.
Ξ 2339... ..	18	29	72	21	273°5	2'41	1	7·2	8°0	'695	L.
Ξ 2344... ..	18	31	61	21	174°9	1'73	2	8·5	12°0	'801	W.B.
OΞ 357	18	31	78	21	230°8	0'40	3	7·5	7·6	'544	W.B.
OΞ 358	18	31	73	6	12°4	1'90	2	6·8	7·2	'526	W.B.
					12°7	2'05	1	...		'695	L.
Ξ 2349... ..	18	33	56	37	204°9	1'28	1	5·5	10°7	'737	L.
Ξ 2352... ..	18	33	55	14	284°9	3'27	1	7·3	10°3	'737	L.
Ξ 2356... ..	18	34	61	23	54°9	0'97	2	8°0	9°0	'526	W.B.
* with Ξ 2356	18	35	61	22	253°4	1'40	1	9°0	9°0	'520	W.B.
Ξ 2358... ..	18	35	59	22	221°8	2'68	1	8·8	9°0	'767	H.F.
Ξ 2360... ..	18	35	69	9	3°5	2'53	1	7·5	8·7	'767	H.F.
Ξ 2362... ..	18	35	54	3	181°3	3'94	1	7·1	8·1	'767	H.F.
Ξ 2367 A.B. ...	18	37	59	48	81°8	0'30	1	7°0	7·5	'737	L.
A.C.					191°1	14'13	1	7°0	8·2	'737	L.
Ξ 2368... ..	18	37	37	45	329°2	1'86	1	7·2	8·4	'821	W.B.
Ho. 437 A.B....	18	37	58	27	299°6	0'36	1	8·3	8·5	'737	L.
C.D.... ..					338°9	3'46	1	11°2	11°7	'737	L.
*	18	37	58	31	163°7	2'97	1	7·5	10°0	'737	L.
Ξ 2369... ..	18	39	87	29	92°3	0'91	2	7·5	8°0	'584	H.F.
Ξ 2375... ..	18	41	84	36	113°8	2'14	2	6·2	6·6	'548	H.F.
					114°6	2'52	1	...		'821	W.B.
Ξ 2400 B.C. ...	18	44	73	52	39°8	0'71	1	10°6	11°0	'737	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Posi- tion Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
Σ 2400 A.B. ...	^h 18 ^m 44	[°] 73 ['] 52	179° 2'	2.60"	1	8.1 10.6	.737	L.
A.C. ...			181° 5'	3.41	1	8.1 11.0	.737	L.
Σ 2402... ..	18 45	79 26	25° 7'	1.10	2	8.0 8.4	.575	H.F.
			28° 5'	0.97	2	...	.605	W.B.
Ho. 89... ..	18 50	52 39	168° 8'	0.43	1	8.0 12.0	.737	L.
β 137	18 51	52 45	133° 1'	1.35	1	8.3 8.5	.737	L.
Σ 2422... ..	18 53	64 2	89° 4'	0.78	2	7.6 7.7	.545	W.B.
			95° 0'	0.74	1	...	.539	H.F.
Σ 2437... ..	18 58	70 58	60° 7'	0.82	2	7.8 8.0	.603	W.B.
			60° 0'	0.84	1	...	.539	H.F.
Σ 2448... ..	19 0	54 28	191° 0'	2.45	1	8.2 8.2	.767	H.F.
Ho. 95... ..	19 2	62 52	221° 9'	0.42	3	8.0 8.0	.606	W.B.
Σ 2455	19 3	67 59	75° 8'	3.54	1	7.2 8.3	.539	H.F.
			72° 7'	3.51	1	...	.591	W.B.
Ho. 444	19 5	63 13	75° 8'	1.31	3	8.4 10.0	.617	W.B.
β 1204 A.B. ...	19 7	87 33	3° 6'	0.37	1	7.7 8.5	.557	H.F.
Ho. 101	19 9	59 10	105° 8'	1.95	1	9.3 10.0	.512	L.
Σ 2488... ..	19 11	70 9	329° 0'	1.56	2	8.5 9.7	.545	W.B.
O Σ 368	19 12	74 1	216° 5'	0.85	2	7.3 8.5	.594	W.B.
O Σ 371	19 12	62 43	156° 6'	0.71	3	6.8 6.9	.599	W.B.
Ho. 576	19 16	83 22	181° 3'	3.85	1	7.0 10.7	.610	H.F.
Σ 2525... ..	19 23	62 52	311° 7'	0.56	4	7.4 7.6	.626	W.B.
Σ 2536... ..	19 27	72 26	78° 0'	1.83	1	8.0 11.0	.627	L.
O Σ 375	19 30	72 6	151° 9'	0.58	3	7.2 8.4	.617	W.B.
			154° 1'	0.52	1	...	.627	L.
Σ 2544 A.B. ...	19 32	81 55	210° 7'	0.94	1	7.8 9.5	.610	H.F.
			206° 7'	1.01	1	...	.627	L.
β 658	19 40	63 7	285° 6'	0.52	1	6.5 9.5	.627	L.
Σ 2583... ..	19 44	78 26	114° 4'	1.21	1	6.0 6.8	.819	H.F.
Σ 2584... ..	19 44	68 5	296° 8'	2.06	1	8.5 8.5	.525	L.
Σ 2586... ..	19 44	65 16	224° 8'	3.75	1	7.3 10.2	.525	L.
O Σ 387	19 45	54 58	327° 2'	0.53	4	7.2 8.2	.697	W.B.
Σ 2585 A.C. ...	19 45	71 6	310° 2'	8.56	5	5.7 8.8	.617	W.B.
A.G.C. 11 A.B.			154° 3'	0.21	2	5.7 6.2	.807	W.B.
Ho. 580	19 48	67 48	272° 3'	0.69	3	8.0 8.1	.579	W.B.
Σ 2596... ..	19 49	74 59	327° 7'	1.95	1	7.2 8.6	.819	H.F.
Σ 2597... ..	19 50	97 0	89° 1'	1.40	1	6.9 8.0	.610	H.F.
Σ 2600... ..	19 51	67 46	56° 7'	3.21	2	8.3 9.7	.545	W.B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Posi- tion Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
	h m	° ' "						
Σ 2600... ..	19 51	67 46	58° 5'	3' 10"	2	8.3 9.7	'541	L.
B.D. + 24° 3798								
A.B. ...	19 54	68 8	276.9	1' 25	2	9.0 10.4	'541	L.
			277.7	1' 50	2	...	'641	W.B.
A.C. 16 ...	19 54	63 1	61.1	0.36	1	7.8 8.2	'512	L.
Ho. 583 ...	19 55	68 10	257.0	1' 54	1	9.0 10.7	'630	W.B.
			263.6	2' 02	1	...	'512	L.
			279.5	2' 00	1	...	'512	L.
			294.4	2' 44	1	...	'512	L.
Σ 2606... ..	19 55	57 0	136.9	1' 12	1	7.5 8.2	'737	L.
Σ 2607 A.C. ...	19 55	48 0	293.3	3' 18	1	7.2 9.2	'512	L.
OΣ 392 A.B. ...			305.4	0.33	1	7.2 9.0	'512	L.
OΣ 395 ...	19 58	65 21	99.8	0.64	3	5.8 6.2	'580	W.B.
Σ 2616... ..	19 58	75 42	254.8	3' 47	1	6.8 9.7	'873	W.B.
Σ 2620... ..	19 59	78 30	293.4	1' 86	1	8.2 9.3	'868	L.
Σ 2624... ..	20 0	54 15	174.4	1' 99	1	7.2 7.8	'912	W.B.
Σ 2626... ..	20 0	59 45	125.8	1' 23	1	8.0 8.2	'923	W.B.
β 57 ...	20 1	74 47	122.4	2' 12	1	6.7 11.3	'868	L.
Σ 2627... ..	20 2	85 32	30.5	3' 91	1	9.0 11.5	'868	L.
OΣ 398 ...	20 4	54 34	76.4	0.98	1	7.3 9.8	'512	L.
Σ 2651... ..	20 9	74 9	109.5	1' 40	1	8.0 8.0	'873	W.B.
Σ 2665... ..	20 15	75 57	19.1	3' 28	1	6.5 9.2	'873	W.B.
Σ 2666... ..	20 15	49 35	246.5	2' 53	1	6.5 8.7	'901	H.F.
Σ 2668... ..	20 17	50 56	288.2	3' 30	1	7.0 9.2	'923	W.B.
Ho. 457 A.B. ...	20 21	60 58	61.0	1' 96	2	8.1 8.1	'545	W.B.
β 670 ...	20 28	76 24	41.9	0.50	2	8.5 8.9	'701	W.B.
Σ 2695... ..	20 28	64 32	76.4	1' 05	2	6.2 8.0	'545	W.B.
β 151 A.B. ...	20 32	75 45	38.9	0.24	4	4.7 6.1	'700	W.B.
			34.3	0.35	1	...	'818	H.F.
			47.5	0.29	1	...	'871	L.
Σ 2702... ..	20 32	55 11	204.8	3' 34	1	8.5 8.7	'901	H.F.
Σ 2705... ..	20 34	56 59	264.8	3' 04	1	7.1 8.1	'912	W.B.
Σ 2723... ..	20 40	78 3	99.6	1' 44	1	6.4 8.2	'873	W.B.
Berlin Zone ...	20 41	65 40	357.2	1' 95	2	9.0 9.1	'545	W.B.
OΣ 413 ...	20 44	53 53	64.0	0.59	1	5.0 6.3	'912	L.
Σ 2739... ..	20 55	70 20	254.0	3' 05	3	8.3 8.8	'782	W.B.
Σ 2744... ..	20 58	88 52	163.3	1' 45	2	6.3 7.0	'667	W.B.
			164.4	1' 40	2	...	'816	H.F.
Σ 2746... ..	20 58	51 8	293.2	1' 08	2	8.0 8.6	'922	L.

Star's Name	R.A. 1900. h m	N.P.D. 1900. ° ' "	Posi- tion Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
Hu. 691 ...	21 3	55 30	318° 7'	0" 25	1	8.5 9.0	.742	L.
Σ 2762...	21 4	60 12	309° 6'	3' 41	2	6.0 8.0	.775	W.B.
			310° 8'	3' 39	1	...	.745	L.
Σ 2765...	21 6	80 51	86° 8'	2' 88	1	7.8 8.0	.737	L.
Σ 2767...	21 6	70 27	30° 4'	2' 35	2	7.8 8.2	.821	W.B.
Ho. 152 ...	21 8	62 4	321° 0'	0' 43	1	8.6 9.2	.742	L.
OΣ 535 A.B. ...	21 10	80 24	20° 4'	0' 26	4	4.1 4.1	.692	W.B.
			23° 2'	0' 31	4	...	.816	L.
			21° 2'	0' 35	2	...	.842	H.F.
OΣ 430 ...	21 7	66 15	203° 1'	1' 47	1	7.8 9.8	.742	L.
Σ 2785...	21 14	50 40	236° 8'	3' 23	1	8.1 10.0	.912	L.
OΣ 437 ...	21 17	57 58	43° 2'	1' 78	1	6.5 7.2	.780	W.B.
Σ 2797...	21 22	76 45	217° 1'	3' 16	2	6.7 8.2	.827	W.B.
Σ 2799...	21 24	79 21	297° 7'	1' 43	2	6.6 6.6	.614	W.B.
Σ 2802...	21 28	56 38	188° 8'	3' 40	1	8.0 8.0	.912	L.
Σ 2804...	21 28	69 44	335° 6'	2' 74	2	7.3 8.0	.562	W.B.
β 167 ...	21 32	60 24	95° 4'	1' 90	1	7.0 12.0	.742	L.
OΣ 445 ...	21 35	69 44	293° 7'	0' 72	1	8.0 8.5	.742	L.
OΣ 448 ...	21 37	61 7	236° 5'	2' 10	1	7.7 8.7	.742	L.
Σ 2822 A.B. ...	21 40	61 42	121° 0'	2' 17	2	4.0 5.0	.655	W.B.
β 989 A.B. ...	21 40	64 49	124° 8'	0' 26	4	3.9 4.4	.816	L.
			121° 2'	0' 16	3	...	.829	W.B.
Σ 2824 $\frac{A.B.}{2}$ & C. ...	...	...	297° 4'	12' 62	2	3.9 10.8	.845	W.B.
Ho. 166 ...	21 40	62 37	82° 5'	0' 39	3	7.5 7.5	.791	L.
Berlin (B.) 8379	21 41	68 31	359° 7'	1' 97	2	9.2 9.5	.562	W.B.
Ho. 608 ...	21 42	63 10	126° 5'	0' 55	2	8.2 9.7	.741	L.
Ho. 171 ...	21 48	62 40	175° 8'	0' 52	4	8.2 8.2	.664	W.B.
Ho. 609 ...	21 51	60 45	354° 6'	3' 47	1	9.5 9.8	.868	L.
Σ 2849...	21 53	70 15	257° 2'	1' 14	1	8.2 10.7	.912	L.
Σ 2850...	21 55	66 32	257° 7'	2' 87	1	7.2 11.2	.868	L.
Ho. 610 ...	21 57	63 38	242° 4'	0' 82	2	9.0 9.2	.803	L.
Σ 2854...	21 59	76 51	84° 5'	2' 64	2	7.7 8.0	.789	W.B.
Σ 2859...	22 1	69 55	339° 3'	3' 56	1	9.0 9.8	.868	L.
Σ 2868...	22 5	67 56	357° 9'	1' 01	2	8.3 8.8	.789	W.B.
Berlin (B.) 8568	22 10	68 33	21° 1'	2' 47	2	8.8 9.8	.584	W.B.
Σ 2881...	22 10	60 55	97° 9'	1' 51	2	7.7 8.2	.789	W.B.
Σ 2882...	22 10	52 45	327° 8'	2' 63	1	9.2 9.2	.912	L.
Σ 2889...	22 12	64 14	189° 5'	2' 02	2	8.2 10.8	.946	W.B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Dis- tance.	No. of Nights.	Mags.	Epoch 1903.	Obs.
Σ 2900...	h m 22 19	69 39	184° 1'	1' 68"	1	6.0 9.2	.742	L.
Ho. 183	22 20	67 56	219° 3'	2' 36"	1	8.2 11.6	.742	L.
Σ 2905...	22 22	75 22	283° 8'	3' 12"	1	8.5 8.5	.920	H.F.
Σ 2906...	22 22	53 4	3° 8'	3' 83"	1	7.0 10.6	.912	L.
Σ 2929...	22 34	79 59	1° 2'	1' 36"	1	9.0 9.5	.920	H.F.
Ho. 296	22 36	75 59	61° 8'	0' 46"	2	5.5 5.5	.807	W.B.
Σ 2934...	22 37	69 5	150° 8'	0' 83"	1	8.2 9.2	.873	W.B.
Σ 2958...	22 52	78 41	5° 5'	3' 67"	1	7.2 9.5	.969	W.B.
Σ 2968...	22 56	59 27	92° 6'	3' 49"	1	7.0 9.5	.912	L.
Σ 2969...	22 56	63 46	31° 1'	3' 76"	1	8.0 9.9	.912	L.
Berlin (B.) 8840	22 59	67 23	231° 3'	1' 61"	2	9.0 9.5	.857	W.B.
Σ 2974...	23 0	57 10	162° 1'	2' 44"	1	8.0 8.0	.912	L.
Σ 2979...	23 3	50 44	225° 6'	3' 19"	1	8.0 10.0	.958	H.F.
Σ 2989...	23 8	70 33	144° 9'	1' 72"	1	8.5 9.9	.969	W.B.
Σ 2990...	23 8	68 28	63° 6'	2' 18"	2	8.5 8.5	.946	W.B.
Σ 3000...	23 14	65 20	53° 4'	3' 55"	2	8.7 8.8	.983	W.B.
Σ 3012...	23 23	73 55	193° 6'	2' 92"	1	8.7 8.8	.969	W.B.
			193° 9'	2' 62"	1	...	.997	H.F.
Σ 3013...	23 23	73 55	277° 7'	3' 15"	1	7.8 9.3	.969	W.B.
			278° 2'	2' 98"	1	...	.997	H.F.
Σ 3015...	23 23	56 59	190° 8'	3' 07"	1	8.7 8.8	.997	H.F.
Σ 3020...	23 26	71 46	108° 0'	1' 82"	1	7.7 9.7	.969	W.B.
Σ 3023...	23 27	73 9	282° 3'	2' 05"	1	7.0 9.7	.969	W.B.
Σ 3026...	23 31	61 39	277° 8'	3' 56"	1	8.8 9.3	.969	W.B.
Σ 3041...	23 43	73 29	178° 9'	3' 48"	2	8.1 8.1	.946	W.B.